National Aeronautics and Space Administration

Creating user-friendly tools for data analysis and visualization in K-12 classrooms: A Fortran dinosaur meets Generation Y

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Introduction

During the summer of 2007, as part of the second year of a NASA-funded education project in partnership with Christopher Newport University (Chaudhury) called SPHERE (Students as Professionals Helping Educators Research the Earth), a group of undergraduate students spent 8 weeks in a research internship at or near NASA Langley Research Center in southeastern Virginia. Three students from this group (Page, Lankey, and Doughty) formed the Clouds group along with a NASA mentor (Chambers), and the brief addition of a local high school student (Kern) fulfilling a mentorship requirement.

The Clouds group was given the task of exploring and analyzing ground-based cloud observations obtained by K-12 students as part of the Students' Cloud Observations On-Line (S'COOL)

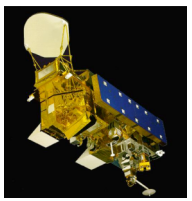
http://scool.larc.nasa.gov

Project, along with the corresponding satellite data. The S'COOL project began in 1997 (Chambers et al, 2003). The primary analysis tools developed for it were in FORTRAN, a computer language commonly used by scientists (especially older ones), but that none of the students were familiar with. While they persevered through computer challenges and picky syntax, it eventually became obvious that this was not the most fruitful approach for a project aimed at motivating K-12 students to do their own data analysis. Thus, about halfway through the summer the group shifted its focus to more modern data analysis and visualization tools, namely spreadsheets and Google™ Earth.

What is S'COOL?

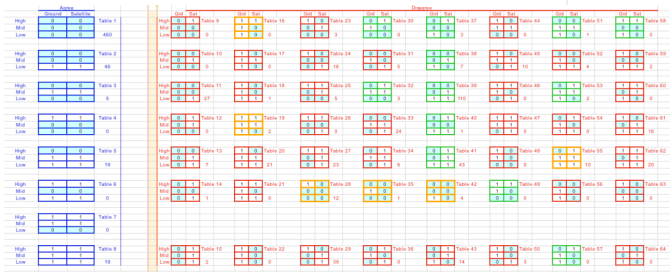
- The Education and Public Outreach portion of the Clouds and the Earth's Radiant Energy System (CERES) project
- A source of ground truth data for CERES cloud retrievals
- Database of ground observations and corresponding satellite data for analysis

Aqua and Terra



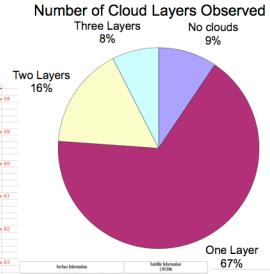
Modern Tool I: Spreadsheets

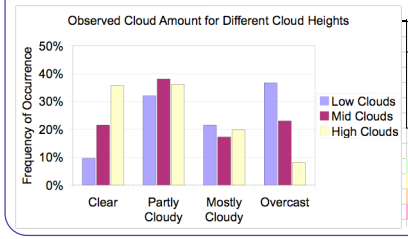
A demonstration Excel file was adapted to create a user-friendly data analysis tool. Many states require the ability to work with spreadsheets around the middle school grade level.



Blue – Agree Green – Explainable Orange – Plausible Red – Unexplained

Cloud Mask Single Comparison ⇒

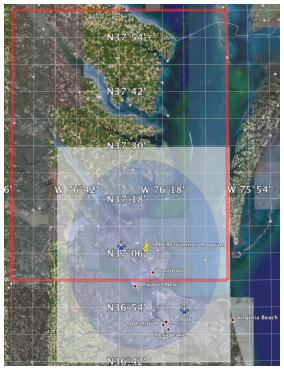




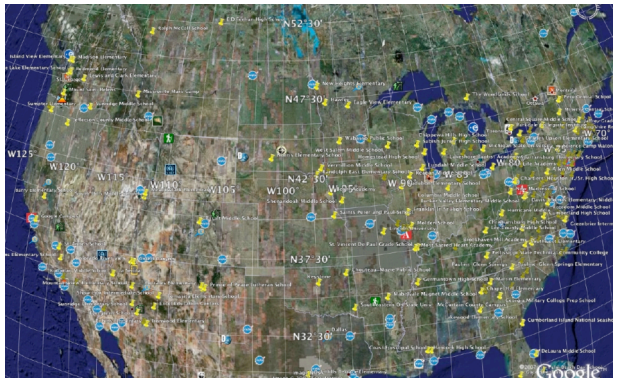
		Ground report				
		No cloud	Clear	Partly Cloudy	Mostly Cloudy	Overcast
Sat report	No Cloud					
	Clear		16	7	4	0
	Partly		33	52	47	26
	Mostly		14	22	47	74
	Overcast		4	4	38	98

Total Cases with Cloud	486	Percentages
Complete agreement	213	43.83
Off by 1 Cloud Cover Class	221	45.47
Off by 2 Classes	48	9.88
Off by 3 Classes	4	0.82

Modern Tool II: Google™ Earth



- Visualize 1 by 1 degree satellite region for initial comparison
- Visualize 0.4 degree radius "footprint" for new comparison

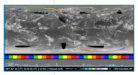


- Pinpoint school locations

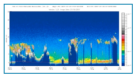
Active Schools ⇒

Overall Goals

- Provide teachers and students with an Excel file, that can be used in the classroom, which allows them to insert their own set of observations and compare them with the satellite data.
- Build on-line tutorials that will help individuals become more familiar with data analysis.



CloudSat tutorial



CALIPSO tutorial

Data analysis tutorial

- Create a Google™ Earth file which gives a footprint around each school to show the area the satellite is measuring.

Other Activities

Observation Pictures

During each observation, pictures of the clouds were taken to be compared with the satellite data, to explore any disagreements.

Shadow Pictures

Shadow pictures were used to help more clearly identify cloud thickness as being opaque, transparent or translucent.

Acknowledgments

Special Thanks to:

- Dr. Eduardo Socolovsky, NSU
- Dr. Margaret Pippin, NASA LaRC
- SPHERE Participants 2006 and 2007
- SPHERE grant NNG06GH31G from NASA Earth Science Education Program

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THE CERES S'COOL PROJECT